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Optimization of FAST Electron Gun Beam Parameters Using *ASTRA*

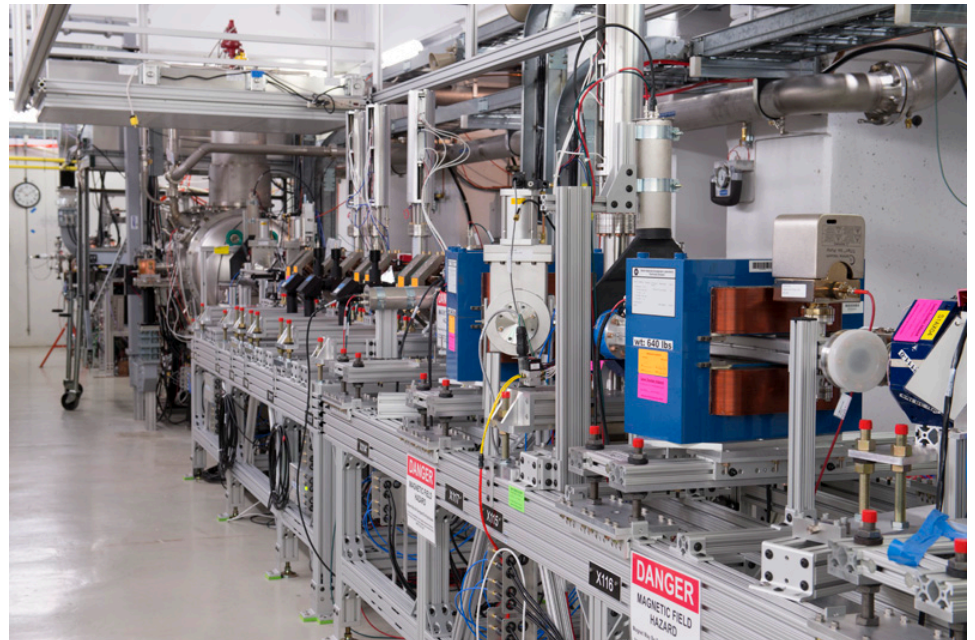
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Argonne Lab Visit

July 24, 2015

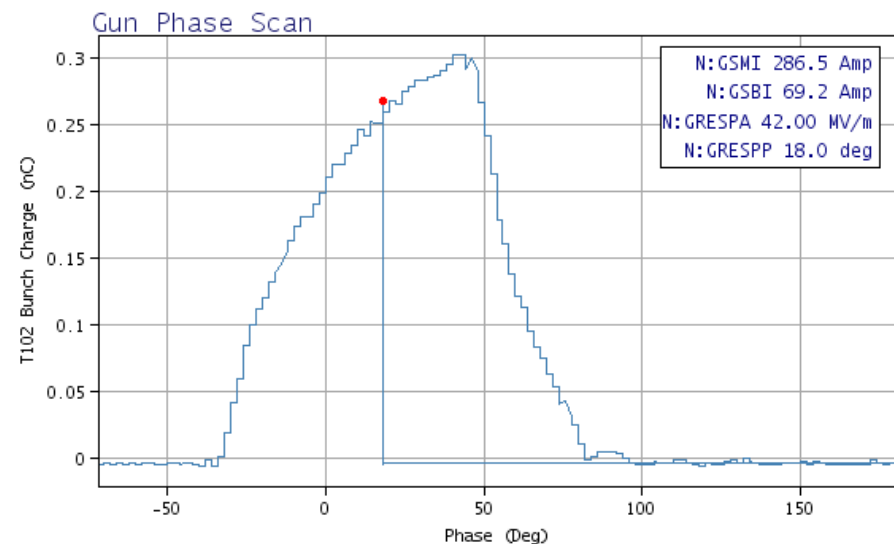
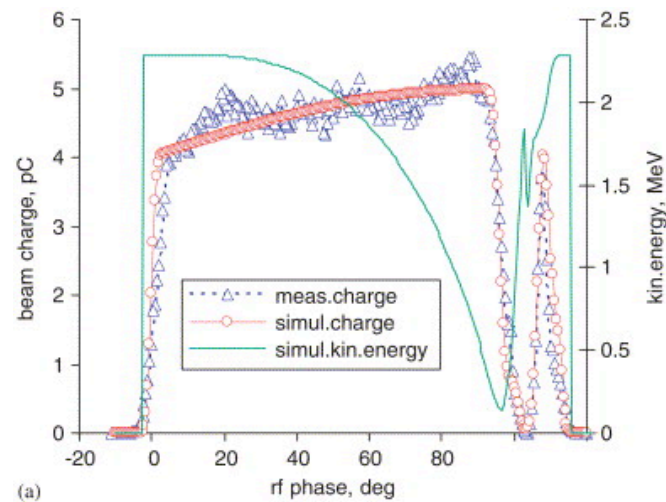
FAST

- RF photocathode electron gun (Cs_2Te)
 - Developed at DESY Zeuthen (PITZ)
 - Normal-conducting $1\frac{1}{2}$ cell 1.3 GHz gun
 - Driven by 5 MW klystron
 - Solenoids to focus beam
- Laser
 - Injection phase
 - Relative phase of pulses with respect to the RF
- Beam charge/intensity
 - Faraday cup
 - Toroid




Toroid Readings

- Charge vs. Phase (of laser) readings had an unexpectedly high peak followed by an abrupt drop-off
- Secondary emission of electrons
 - Increased slope of plateau
- There also existed a smaller peak in charge after the bunch



ASTRA Simulation

- *ASTRA*
 - Written by Klaus Floettmann at DESY
 - Simulation of datasets through a Monte-Carlo approximation
 - Manipulation of parameters
 - Regression analysis for curve-fitting and optimization
- 

```

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <math.h>
#include <time.h>
#include <unistd.h>

#define LINE_CHAR 256 //256
#define LINE_BUF_SIZE 24*LINE_CHAR

int interface();
int param();
int data();
int delta();

void plot(double *data, double *ydata1, double *ydata2, int dataSize);
int* generate(char *name, char line[LINE_BUF_SIZE]);
void writefile(char *file, FILE *out);
void appendfile(char line[LINE_BUF_SIZE], FILE *out);
int* requesting(char *s);

double lumberphone[12] = {-34, -22, -19, 2, 14, 26, 30, 54, 62, 74, 86, 90};
double lumbercharge[12] = {-0.001904040, 0.09956578, 0.150018127, 0.20266439, 0.23615701, 0.26668162, 0.282224613, 0.295986640, 0.313121278, 0.35332556, 0.382344042, -0.0006099};
double simulation[12];
int globalflag[100];

int main()
{
    //char line[LINE_BUF_SIZE];
    //memset("clear", line);

    system("clear");

    //printf("v\n");

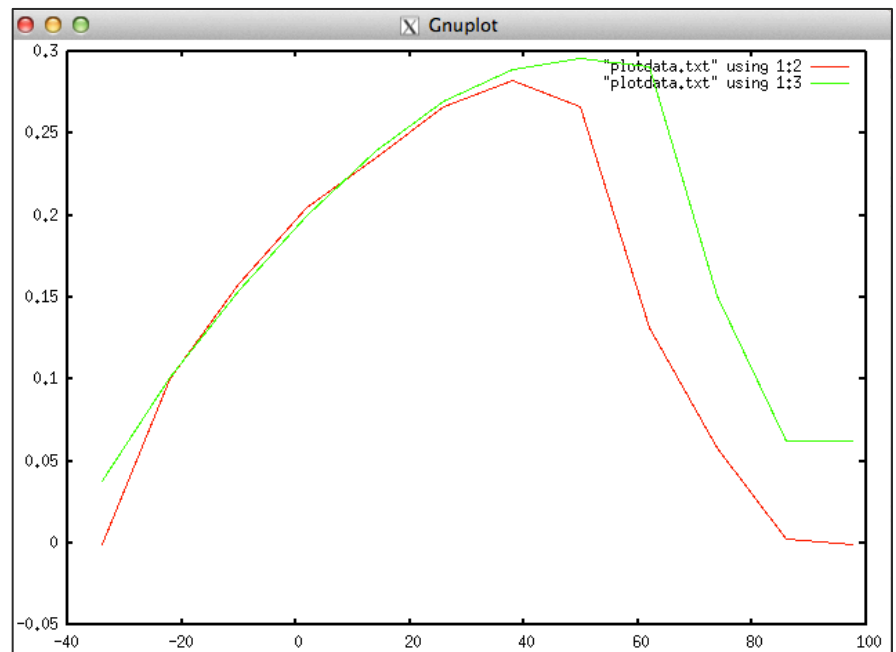
    printf("v\n");

    //printf("0.0025_PER_SEC = 30Vs, 0.0035_PER_SEC);

    interface();

    return EXIT_SUCCESS;
}

```



Special thanks to Elvin and Dan.
Any questions?